

# The Mining Journal

Established 1835

Railway & Commercial Gazette

Vol. CCXLIV No. 6230

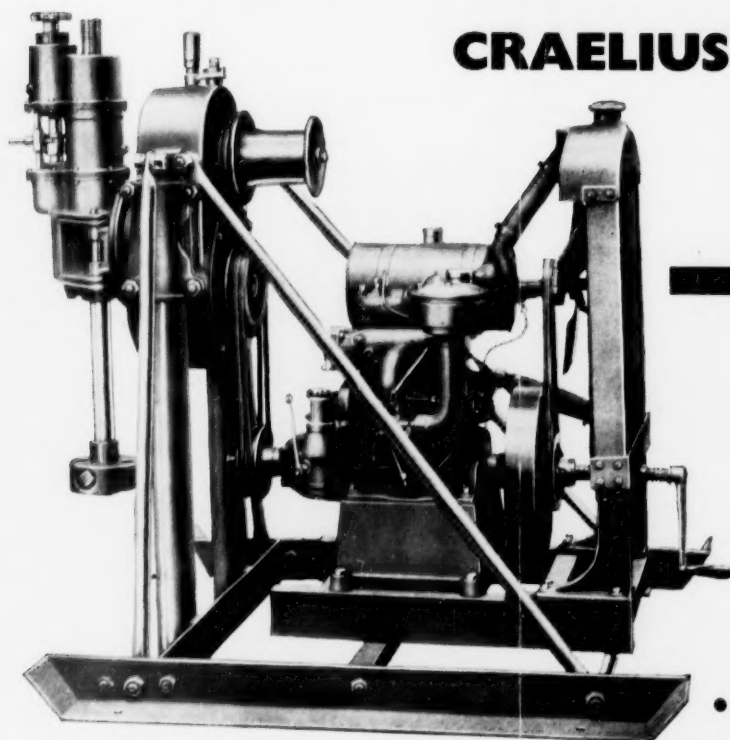
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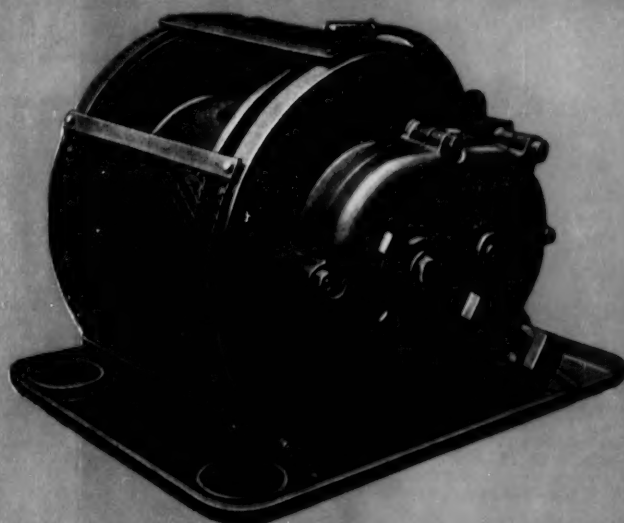


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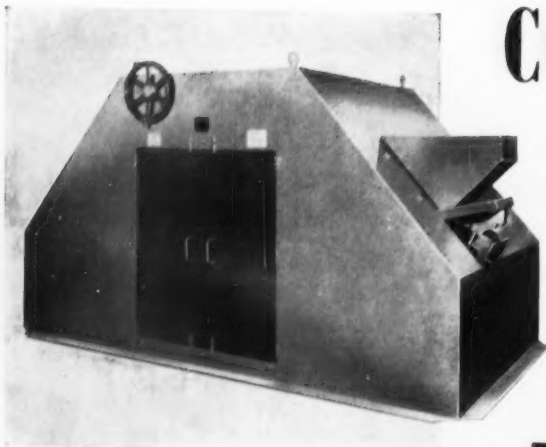
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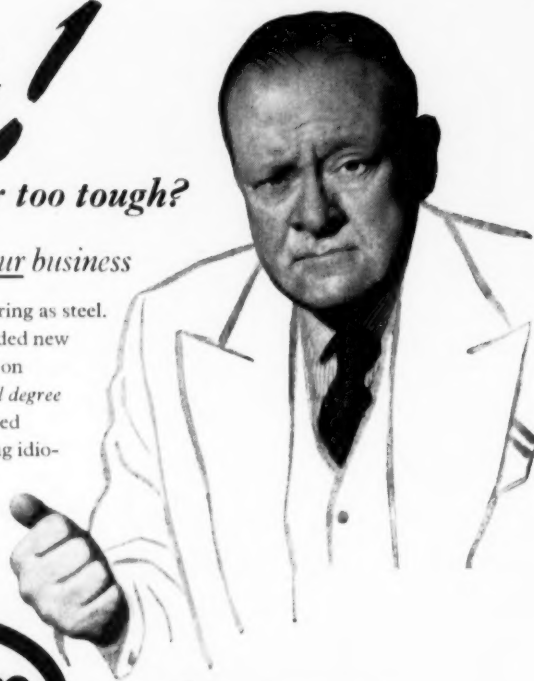
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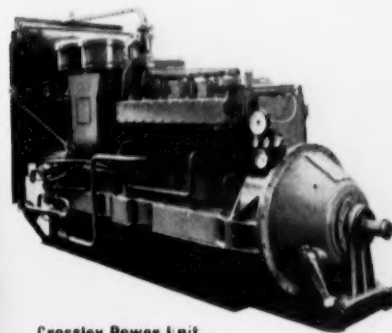
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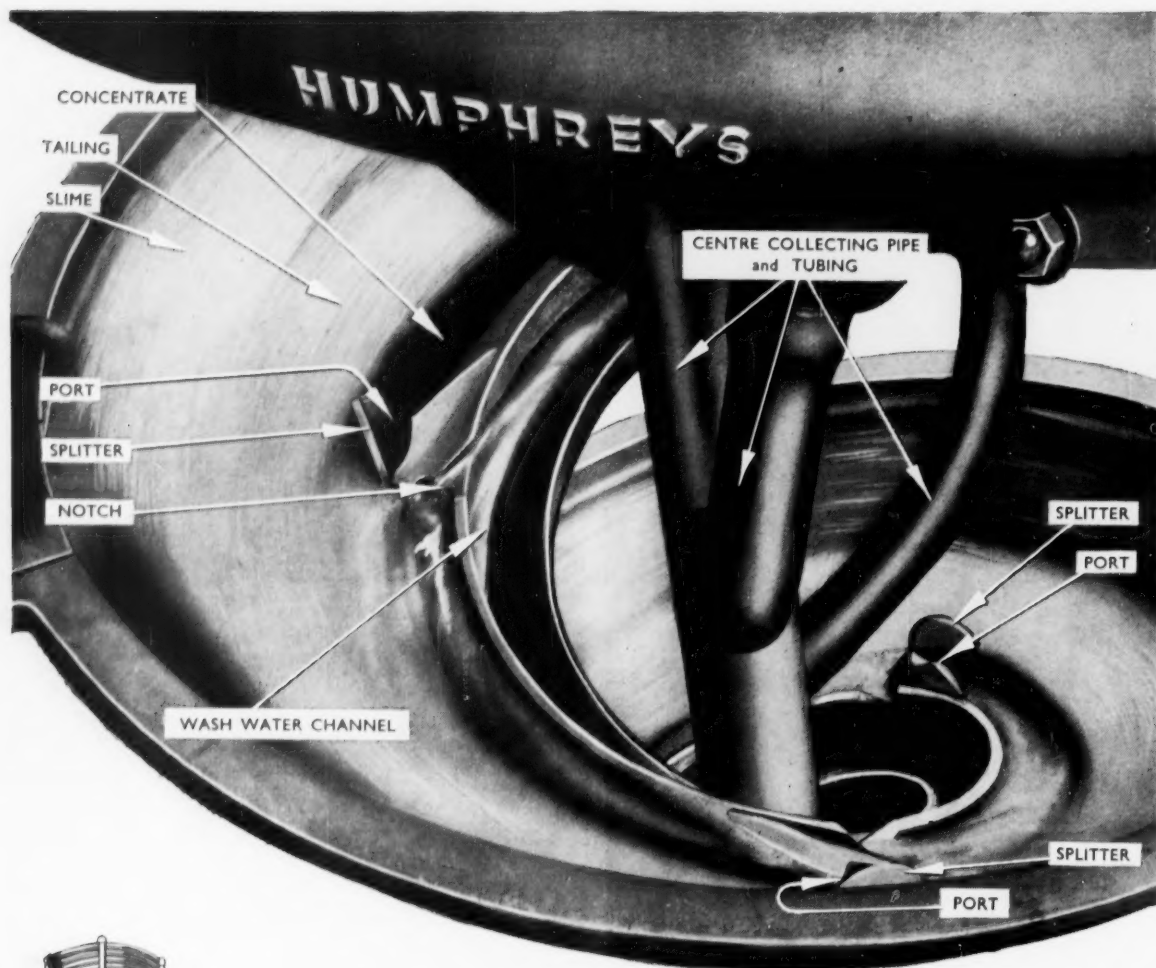


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# The Mining Journal

Established 1835

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## NOTES AND COMMENTS

### President Eisenhower Restates His Case

President Eisenhower's State of the Union Message delivered last week breaks no new ground on the economic front. He has said it all before on at least two other occasions; once in his Message to Congress last year and again in the Randall Commission Report.

But what distinguishes his most recent Message from that of its predecessor is the much firmer economic and political mould into which it can be poured. Most important—from a practical point of view at any rate—is that Congress is now Democratically controlled and that the chairmanship of the House Ways and Means Committee is in the hands of an ardent free trader. Equally important, but for different reasons, is the upsurge the U.S. economy has experienced in recent months; the absence of an election year ahead; and finally, the more settled international outlook.

Seen in this context the President's restatement of policy contained in the State of the Union Message and in his special message on foreign economic policy can be read with optimism engendered by the knowledge that his programme will receive sympathetic hearing in Congress.

That this is so may have accounted for the more confident note on which the whole address was pitched and also for his assertion that the transition to a peace-time economy was largely a thing of the past. In saying this the President did not, of course, imply that the defence budget would be reduced to negligible proportions, but rather that the expenditure required for rearmament purposes could now be assessed with some degree of accuracy thereby providing more scope for attending to the country's economic growth on a basis of what may well harden into a ten-year programme. In fact, the President's programme enumerates an impressive array of projects ranging from road building, housing, and welfare schemes to increased trade, aid and import programmes which, together with the continuation of the government's present stockpiling and military expenditure programmes, will ensure the stimuli needed to expand the U.S. national product by 40 per cent within the next ten years.

The President reiterated his belief that trade barriers should be reduced and stressed once more that this should be accompanied by comparable lowerings of trade barriers by

other nations. A further appeal to simplify U.S. customs administration and procedure was also made and he has requested an extension of the Reciprocal Trade Act for three years which would give him more latitude to cut tariffs than he has under present legislation.

His explicit rejection of autarchical concepts was encouraging as was his declarations that it was essential for the security of the free world that the U.S. takes the leadership in promoting a greater flow of capital among the nations of the free world by international trade, by convertibility of currencies, and by an expanded interchange of technical counsel.

Referring to U.S. private investment abroad, the President recommended legislation to provide it as incentives for the export of private capital while, as a further step to stimulate investment abroad—especially to under-developed areas—the President recommended approval of membership in the proposed International Finance Corporation which would be affiliated to the International Bank for Reconstruction and Development.

### Thorium—Possible Key to Low Cost Nuclear Power

While it has been known for some time that thorium—itsself non-fissionable—could be converted into fissionable uranium, it was not generally known that only a reactor using thorium can breed more nuclear fuel than it consumes. That this is so was announced last week by the U.S. Atomic Energy Commission and points to the interesting possibility that thorium, rather than uranium, may provide the key to future low cost nuclear power.

In the United States, the Oak Ridge National Laboratory is currently carrying out experimental work on the use of thorium reactors and it is believed that the process begins with the use of U-235 rather than plutonium. Since thorium is not fissionable it would require a small quantity of about 1 per cent to 5 per cent, of U-235 to start the nuclear fire. The neutrons from the U-235 would convert the thorium into U-233, so that after the initial amount of U-235 has been used up the U-233 would continue to breed more and more U-233 from the thorium.

According to Mr. William Laurence of the *New York Times* the advantage of a thorium reactor is that it is a

slow neutron reactor and thus does not present the difficulties of cooling and control inherent in a fast neutron reactor. Moreover, its ability to breed more fuel than it consumes may well enable it to compete with coal-generated electricity.

In this connection Mr. Laurence presents some interesting statistics. Each kilogram of U-235, plutonium or U-233, he says, is equivalent to 3,000 tons of coal. Hence, a thorium breeder reactor containing one ton of thorium, enriched with, say, one per cent of U-235 at an estimated cost of U.S. \$100,000 would yield the equivalent in heat of 3,000,000 tons of coal. At \$10 per ton this would represent a yield of U.S. \$30,000,000 in heat energy.

These are early days to speculate on the probable impact of this important development, but there can be little doubt that should the experimental work now being undertaken prove successful it will lead to a revolution in the industrial uses of atomic energy.

Thorium supplies would not, of course, present any difficulty and known reserves—at present prices—are many times greater than uranium. The United States have several deposits scattered throughout the southern states, and in Idaho while there are known concentrations of thorium bearing monazite in Brazil, India, Ceylon, Australia, Malaya and Indonesia.

#### Threat to Kolar Goldfields

The Gold Mining Committee of the Mysore Government has recommended doubling the royalty payable to the State Government by the British owned Kolar Goldfields mining companies. Under the agreement of 1875 these companies pay a royalty of R 20 lakhs. The Committee is also reported to have suggested that the Government should have control of the mines.

In making this announcement Mr. H. Siddaveerappa, Minister for Industries and Chairman of the committee, declined to reveal details of the Committee's recommendations, and only went so far as to say that certain conclusions had been reached in regard to the future of the mines. In any event it was for the Government of Mysore to take action based on the Committee's recommendations, and he hoped that a decision would soon be taken.

It is understood the Committee has not favoured either reimposition of gold duty abolished in 1949, nor immediate nationalization of the industry. Instead, it seems to have urged that the Government should take the steps necessary to see that the mines are worked in the interests of the country as a whole and that the Government should receive the maximum revenue from this source.

#### Peak Value of S.A. Gold Output in December

A new high record was established in December, 1954, for the value of monthly gold output by the Union of South Africa. During this month 1,191,827 oz. were produced which, with gold at 250s. 8d. per oz., amounted to £14,937,000 compared with £14,548,000 for November. During the latter month output was 1,163,068 oz. and the gold price fractionally lower at 250s. 2d.

With the completion of December production, the total output from mines which are members of the Transvaal and O.F.S. Chamber of Mines during the year 1954 rose to 12,682,328 oz. from 11,440,830 oz. during 1953. Thus 1954 was the Union's greatest year of gold production since 1943 when 12,809,021 oz. were produced. If the present high rate of production continues, and the new mines of the O.F.S. continue their progressive increases in output, it seems likely that 1955 may come within striking distance of the all-time record of 1941, when output reached 14,386,361 oz.

## Mr. Prain on the Copper Outlook

At an informal meeting of members of Rhodesian Selection Trust and Roan Antelope Copper Mines, held in London this week, Mr. R. L. Prain said that he considered the two most important matters now confronting the Copperbelt to be the future supply of power and the discussions now taking place on African advancement. No decision had yet been reached by the Federal Government as to whether they would proceed with the Kariba or the Kafue project. The Prime Minister of the Federation had said that the matter required more consideration. They were anxiously awaiting the result of this consideration as, unless a decision was taken soon, they might find that the Copperbelt would be short of power towards the end of the present decade.

Members would, he said, have followed in the Press developments which had been occurring on the question of African advancement. The companies had submitted to the European Mineworkers' Union a plan which was now the subject of discussion between the companies and the Union. He did not think he should say anything more but there was in his opinion a genuine willingness on all sides to reach some agreement on the important question.

#### THE PRICE OF COPPER

In reply to a question as to whether the companies had taken part in recent discussions of Commonwealth copper producers, he said that there had been discussions on the question on the fixing of copper prices and they had taken part in them. They took the view that the copper market required a greater measure of stability than it was experiencing to-day in this country. There were really two copper prices in the world to-day, one of them relatively stable to which most of the world's major producers adhered, and the other in, roughly speaking, the Commonwealth, based on the London Metal Exchange price, which was very much higher than the first one mentioned and which had been moving considerably. The situation obviously had to be considered very carefully and all he could say at the moment was that it was very much under review. The whole question obviously needed very careful consideration in view of the disparity of some £40 to £50 between the two markets.

#### WORLD PRODUCTION

He was asked whether he could give any idea of how much new copper production was likely to be available in the world in the next few years, and in reply he said that he estimated that 450,000 s.tons of new copper would come into the world per annum in the five years 1953-58, and the total might be greater. He calculated that about 264,000 s.tons of new production would be coming from the United States after allowing for mines which had gone, or were going, out of production; 81,000 tons in Canada; 76,000 tons in Africa and 45,000 tons in Yugoslavia. Then there had been an announcement of developments in Peru, where four large American mining companies were going to develop an area containing probably the biggest undeveloped mine in the world. They had not said when or at what rate they would produce but he had reason to think that the figure would be at least 100,000 tons a year, bringing new production in the next five years to over 550,000 tons.

Replying to a question on the subject of prospecting on the Copperbelt, he said that they were exploring a huge area of 35,000 sq. miles and had found a good deal of mineralization. They were trying to keep down costs and were taking advantage of many modern inventions includ-

ing aerial photography and were studying the possibility of using helicopters. Their policy was to concentrate on small parts of the area to which some day they might return and do some drilling. To that extent he could say that the results of exploration were promising but intensive work would be necessary on the selected spots. He could not say that they had yet discovered any new orebodies.

## Mexico

(From Our Own Correspondent)

Taxco, December 22.

Speaking in Mexico City recently, Senator Alberto Terrones Benitez stated that nothing had been done to create a new era for the Mexican mining industry and that the government had shown only indifference since 1936.

Despite the fact that the mining industry this year will pay federal taxes of around 800,000,000 pesos (\$64,000,000), the government has only granted 20,000,000 pesos (\$1,600,000) in subsidies. This does not constitute an outright grant, but a deduction from federal taxation. Mining circles testily charge that this sum is far from sufficient to aid small and medium sized operations burdened with official laws, decrees, circulars and other "government intervention" that hinders operations and kills all incentives for expansion.

### POLITICAL DOLDRUMS

Reforms in mining tax laws have been assailed by miners as inadequate and as supplying no actual relief from taxation or government interference in the industry. Miners are highly pessimistic that the Rio conference will provide any solution to local problems. Senator Benitez summed it up by saying: "Conferences of this type have been held periodically for over 30 years without any material result benefiting international economic problems."

Mine operators feel that only by the creation of an efficiently organized Department of Mines can the problems that are steadily weakening the industry be solved. Above all, what is needed at once to save the grave situation of small and medium mines is a "tax holiday." This the government is not disposed to grant so the actual situation steadily becomes worse from day to day.

Mining circles have also put pressure to bear on the administration to abolish the law which declares deposits of radioactive substances as "national mining reserves."

### NEED FOR MINING RESERVES

The National Federation of Mines has urged that the Mexican government initiate special premium payments to prospectors who discover uranium or other radioactive metal deposits, as is done by the U.S. and other countries.

At its annual convention the Federation warned of the necessity to build up mining reserves in the republic—reserves being seriously depleted by closure of operations and the cutting of work hours on units still operating. The most serious situation, the Federation pointed out, is the cancellation of manganese import contracts by the United States. Of a total production of 550,000 tons, Mexico has only exported 350,000 and has lost an income of 125,000,000 pesos (\$10,000,000).

On the credit side is the cheering fact that exports of silver to Europe increased in the first 10 months of 1954, totalling 32,500,000 oz. against a total export figure of 30,400,000 oz. in 1953. Uninterrupted shipments have been made to satisfy the needs of foreign industry, chiefly to France and Germany. It is predicted that the total shipments for 1954 will be in the region of 40,000,000 oz., an output which will earn approximately \$34,000,000.

## South Africa

(From Our Own Correspondent)

Johannesburg, January 1.

All things considered, the outlook for the mining industry during 1955 is bright. More power should become available and the native labour supply should continue to present a more satisfactory picture and it is estimated here that the value of the gold and uranium outputs should be very much in excess of £200,000,000. More new mines will get underway, notably Saaiplaas. Van den Heever's Rust may also get going, but there seems to be some difficulty in arriving at a lease area for this property in view of its geology. Another property about which something is expected to be heard soon is the Sandpand—Klerksdorp Townlands to the west of Hartbeestfontein. A strong rumour exists here, although no official confirmation is obtainable, to the effect that Ellaton's claim area will be increased by taking over some ground from Western Reefs and that the company will be floated off as a separate entity before very long. Another rumour is that things are starting to boil up with regard to the opening up of Western Ultra Deep in the foreseeable future.

At Buffelsfontein good progress has been made with shaft sinking and if maintained it is estimated that the date of production—at present scheduled for April, 1956—will be brought forward appreciably. At Hartbeestfontein development footage advanced has also been very good. Indeed, either or both of these mines might have set up new records but the properties have suffered power cuts of late. This difficulty should, however, be eliminated once the additional units at the Vierfontein Station are commissioned.

In the matter of shaft sinking considerable interest is being displayed in a modified ventilation fan currently being tested on a West Rand mine. This new modification consists of a type of sluice gate which allows a high speed reversal of the air flow without stopping or slowing down the fan itself. If successful, it should lead to a reduction in the re-entry time in the shaft after blasting and thus speed up sinking cycles.

On the reduction side of mining, work on the reef sorting plant at West Driefontein and Doornfontein is almost finished, and these should be in full operation later in January. Once this is done it will be possible to form an estimate of the full effects it will have on the milling grade at these two properties.

## Portugal

(From Our Own Correspondent)

Oporto, December 28.

The recent reduction in the export tax value on tungsten ores materially helped exporters to compete with other producing countries, but with U.S.A. and Sweden not interested and the U.K. and Germany only interested to a minor extent, the benefits resulting from a far too long delayed measure have still to be reaped.

With the recent drop in the value of tin the export of tin ores becomes more and more difficult. The export duties are 5 per cent *ad valorem* which leads exporters to turn their attention to smelting the ore in this country and then exporting or selling on the local market. Export duties on the metal are one per cent, but to erect an expensive smelting plant and then to experience one of the numerous distressing surprises that have so frequently been sprung on the trade is a risk that the majority of producers are not keen to take.



## S.A. MINING TRENDS—VIII

# Current Mining Practice at Stilfontein Gold Mining

Stilfontein Gold Mining Company Ltd., the Far West Rand gold/uranium producer in the General Mining and Finance Corporation Group, was registered in South Africa in April, 1949. Gold production commenced in July, 1952, and the uranium plant began operations in October, 1953. In the following article, which has been specially contributed to *The Mining Journal* by a South African correspondent, the current standard mining practice adopted on the property is described and attention is drawn to the interesting construction of the Margaret Shaft headgear.

Stilfontein Gold Mining is equipped with two shafts, the Charles Shaft and the Margaret Shaft. Charles Shaft, 39½ by 11½ ft., is a rectangular, vertical shaft with six compartments of which two are stripped for upcast ventilation, the others being downcast and used mainly for transporting men and materials. Margaret Shaft, 43½ by 12½ ft., is a rectangular, vertical shaft with six compartments, four of which are used for hoisting mainly ore and waste rock. Two compartments are bratticed off for upcast ventilation and will temporarily be used solely for that purpose, the other four being downcast. Two double-drum heavy duty, 3,000 h.p., 2,165 ft. per min. winders have been installed combined with the Ward-Leonard control system and General-Electric equipment.

## REINFORCED CONCRETE HEADGEAR

The headgear was the first reinforced concrete installation erected in the Union. This headgear has six legs, is 125 ft. to the sheave wheel centre, and 155 ft. to the gantry. From the 10-ton skips, waste is tipped through manually operated gates on to a conveyor belt and trammed from a surge bin to the waste dump. The gates are closed during ore-hoisting. The ore is discharged through chutes into a 4,500-ton reef bin partially countersunk in the ground and forming an extension of the headgear foundations. The 10-ton skips and three-deck cages are interchangeable and in turn can be removed from the cross-head and bridle, and suspended from the turntable crawl carriages mounted on the headgear.

Standard and proved practice has been followed in opening up the lease area. The main economic horizon is the Vaal Reef, but the Ventersdorp Contact horizon persists extensively in the property, as indicated by the drilling



The Reduction Plant

results. Recognized essentially as a gold carrier, this reef may eventually be of considerable supplementary economic importance.

Initially, the Vaal Reef was opened up by reef drives and raises, with footwall crosscuts taken back under the raises and connected with the latter by box-holes. Owing to the numerous parting planes in the hanging, however, which is thereby rendered unstable, footwall haulages are now advanced at vertical intervals of 195 ft., with crosscuts driven to reef, whence raises are cut with boxes leading down to the crosscuts. The raises are spaced about 600 ft. apart on strike with intermediate gullies driven from them into the reef at intervals of 150 ft. on dip. These gullies carry ½-ton end-tipping cars on 18 in. tracks.

The broken ore from the blasted stope faces is mechanically scraped into the cars which are trammed to and discharge through the raise boxes to ball-and-chain gates and chutes in the footwall crosscuts. The chutes feed into 4-ton side-dropping cars hauled by Diesel locos to the shaft pass-system.

The present stoping width is 36 in. Waste rock walls built up at the gully sides direct the ventilation flow from the raises up the stope faces. Development ends are cleaned by mechanical loaders discharging into 4-ton cars into which are hand-lashed the remaining fines.

## THE CURRENT PROGRAMME

Deepening the Margaret Shaft has been deferred to 1957. Excluding this operation, the current capital expenditure programme will have been largely completed by the present time. This programme includes the surplus development required to build up ore reserves to the equivalent of three years' milling. At that level, development will be reduced to a rate commensurate with maintaining ore reserves at that equivalent. It is expected that eventually another sub-incline hoisting shaft—sunk from the lowest level of the Margaret Shaft—will be required to open up the deeper southern section of the mine.

The current programme aims at a monthly milling rate of 90,000 tons but the attainment of that tonnage is de-



The Margaret Shaft



pendent on the native labour available. Waste sorting in the crusher section was reported at 20 per cent. This has contributed to raising the mill grade, and may decrease costs in terms of ounces produced. The Vaal Reef band is narrow and carries high values, and sorting errors can therefore be expected with unskilled labour. Provision has accordingly been made for "reef-picking" from the sorted waste.

The crusher section has been designed with open circuits throughout and vibrating grizzlies have been installed. The main units in the mill sections are two primary rod mills in open circuit with rake classifiers. In turn, the latter are in closed circuit with 12 secondary tube mills. The rod mills have been installed with their axes at right angles to the feed belt assembly and parallel to the wall. The mill drive assembly is on the open side and

clear of the feed belt. Space is thereby saved and maintenance facilitated.

Extensions to the uranium plant have been completed and will soon be commissioned for the treatment of residue slimes from Afrikander Lease, Babroscro, Ellaton and New Klerksdorp mines. A large contact sulphuric acid plant is being erected at a cost of £750,000. Cyclone classifiers are under test in the mill.

To prevent finely broken ore from being thrown back by the blast into the stoped out area, a scatter-wall is formed on the dip-line from a portion of the broken ore. As the face is advanced further, another scatter-wall is built-up, and the wall already formed behind it is scraped down into the gully cars. Fines not removed by the scraper are dry-swept down to the gully cars. This rotation is repeated as the face is advanced further.

## Uranium Mining Project at Radium Hill, South Australia

**Radium Hill, the first phase of South Australian uranium development to reach maturity, was brought into production on November 10, 1954, when the Governor-General officially opened the project. Capital investment on mine development and treatment plant at Radium Hill already represents £A5,000,000 and the annual operating budget is set at £A2,000,000. The following article outlines the development of the Radium Hill mine and describes the sequence of ore treatment. Although the ultimate expenditure on Radium Hill cannot be assessed, the mine as it exists to-day is clearly no more than the beginning of an important undertaking.**

The development of the Radium Hill, South Australia, uranium deposits began originally in 1906 when the first shaft on what is now the main lode line was sunk in a search for radium, and small amounts were worked intermittently from 1908 to 1931 as extractions from uranium ores. When the value of uranium became recognized, however, attention was immediately directed to surveying the Radium Hill area following a request by the United Kingdom Government. The survey revealed that the ground was uranium-bearing, yet much depended on the evolution of an economic process to ensure efficient extraction of the oxide from the complex ore formation.

Two pilot plants were established to experiment with production techniques. One was at Radium Hill itself, and the second at the Adelaide suburb of Thebarton. The State Government in the meantime pressed its hunt for uranium across 100,000 square miles of South Australia that showed geological promise. At the same time, parallel investigations on chemical processes were started in Mines Department laboratories at Parkside, Adelaide.

When the geological survey was launched, two uranium localities were the only certainties, judging from reports made by past prospectors. They were at Radium Hill and at Mount Painter, in the Flinders Ranges 400 miles north of Adelaide. Roads were constructed to Mount Painter, and ore was brought out on the backs of camels.

But this quarter was finally abandoned and the primary target became Radium Hill. Nine square miles there were labelled as a mining sector.

From May, 1952, preparations were hurried for full-scale output. Meanwhile, an effective ore-dressing concentration method had been evolved. Pure uranium oxide, representing the last stage in the treatment of crude uranium before smelting into uranium metal, was first produced in Australia at the pioneer pilot plant set up at Radium Hill, near the end of 1953.

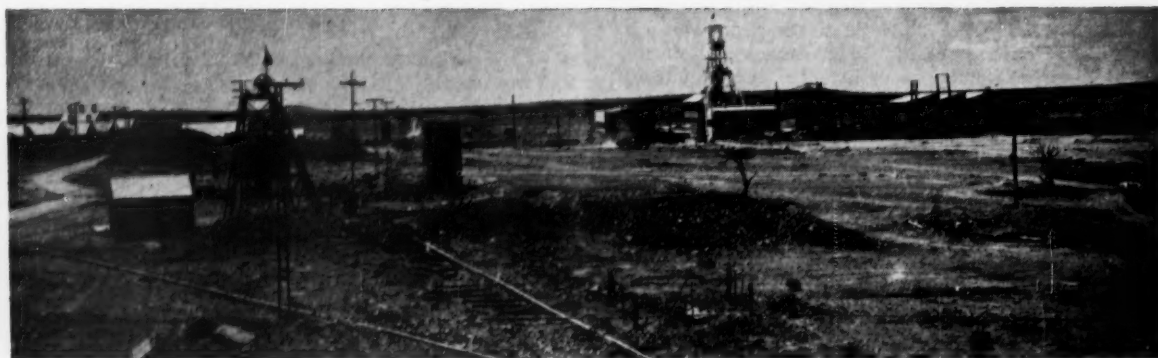
Associated with the installations at Radium Hill, one of the largest plants in Australia for advanced chemical processes is to be established at Port Pirie. At this port a sulphuric acid leaching plant will extract pure uranium oxide. The estimated cost of this plant will be £A1,500,000.

The population of Radium Hill is at present approximately 550 persons, who enjoy all the social and domestic amenities provided in the modern township near the mine. Some fifty per cent of the labour force comprises immigrants from the Continent, and under a migration plan to recruit more workers and to increase the population of Radium Hill at least 1,000 experienced miners are to be sought in Germany and Italy.

The headframe at the main shaft is 130 ft. high and of shaft itself has been sunk to a depth of 750 ft. The final



The headframe of the Main Shaft



The silver headframe and the ore concentration plant. Diggings in centre show where prospecting took place in 1906.

depth will be 2,000 ft. and the deepest known ore bodies lie at 1,500 ft. depth. Eight miles of development have been completed on three levels.

The lode has a maximum width of 17 ft. and an average width of 4 ft., with well defined walls. The lode dips from 30 deg. to 70 deg. and the deposits appear to be extensive.

The ore is a coarse aggregate which includes davidite, ilmenite, rutile, magnetite, haematite, pyrite and chalcopyrite, with quartz and biotite. The country rock is Pre-Combrian greissic rock, a characteristic of the Broken Hill district, New South Wales, some 70 miles distant. Uranium is present in the mineral davidite which contains up to 9 per cent  $U_2O_5$ , approximately 50 per cent titanium oxide, 30 per cent iron oxide, and a maximum of 8 per cent rare earths. Carnotite occurs near the surface, coating the davidite.

From the Radium Hill main shaft the ore is carried in large fragmentation up an elevator chain to a hopper where it is released by gravity into crushers. After crushing the raw material is conveyed by elevator belts to a concrete storage bin. It is passed into the mill for further crushings and metallurgical processing by flotation. The thickened concentrate goes by rail to Port Pirie for additional refinement.

The concentration process eliminates a high percentage of the waste material in the ore and permits a product of relatively small bulk. Techniques resembling those in base-metal concentration plants are employed, except that special re-agents are used in the various units. These re-agents were developed after several years of intensive work in the Adelaide laboratories of the South Australian Department of Mines.

The immense plant has been constructed for easy cleaning and maintenance, and is under push-button control.

#### PROBLEMS OF SUPPLY

Three major problems, those of water and electricity supply and of transportation, have been successfully overcome at Radium Hill.

The difficulty of water supply was overcome by running a 6 in. underground pipeline 53 miles from the Umerumberka Reservoir at Broken Hill. The Umerumberka Reservoir is fed by the Darling River. This water is stored in tanks at Radium Hill and the pipeline can deliver 1,250,000 gal. per week. Electric power for the field comes by a 132,000 v. transmission chain from Morgan, on the River Murray, 125 miles to the south. This probably will be extended later to service Broken Hill. From the township of Cutana, on the main direct routes between Adelaide and Broken Hill, a railway spur line and road have been

built 13 miles westwards to Radium Hill. Commercial aircraft call at the aerodrome three times weekly. Flying time to Adelaide is about one and a half hours.

South Australia now has six separate sectors where the uranium indications demand closest inspection. One of the most significant is 70 miles north of Radium Hill, at Crockers Well. Here there have been 600 different reports of radio-active symptoms.

The Premier of South Australia, Mr. T. Playford, has announced that an industrial concern and mine workings might well be operating at Crockers Well within three years. "These discoveries," he stated, "can usher in a period of close co-operation between State and Commonwealth authorities aiming at nuclear power for Australia." The Radium Hill-Crockers Well region comprises almost 4,000 square miles of uranium-type ground structure.

## Soviet Metal Production

Of particular interest in the 42nd annual compilation of world metal statistics to the end of 1953, published by The Metallgesellschaft A.G., are the production and consumption figures from countries within the Soviet sphere of influence.

In view of the scarcity of Soviet statistics, these are valuable even after making allowance for the fact that to a considerable extent they can only be, and indeed only claim to be, estimates.

Except in the case of copper, these figures exclude, so far as possible, the production and consumption of secondary metal.

#### PRODUCTION AND CONSUMPTION—1953 (in metric tons)

		<i>Soviet Sphere</i>	<i>Free World</i>
Aluminium	Production	309,800	2,141,800
	Consumption	327,000	2,086,400
Lead	Smelter Production	246,000	1,732,000
	Consumption	291,000	1,602,700
Refined Copper	Production	446,000	2,937,000
	Consumption	529,000	2,649,300
Zinc	Smelter Production	318,000	2,036,900
	Consumption	318,000	1,772,700
Tin	Smelter Production	16,600	177,800
	Consumption	20,900	123,300

#### PRODUCTION ONLY—1953

		(in metric tons)	
Cadmium	...	280	6,675
Magnesium	...	45,500	100,800
Nickel	...	26,000	163,200
Mercury	...	600	4,813
Silver	...	825	5,815

# Effects of Landslides on Mining Operations in the United Kingdom

By A. NELSON

The problem of landslides is of particular importance in the United Kingdom owing to the loosening effect of rainfall and because in this country many mining operations, both opencast and subsurface, are carried on in narrow, steep valleys prone to this type of earth movement. The following article describes the various causes of landslides and concludes by indicating certain preventative measures.

Many sites favourable for open-pit mining operations are also favourable geologic and topographic structures for landslides. When the equilibrium of the rock masses is disturbed by mining operations or other causes, gravitational readjustments of the deposits must occur to meet the new conditions. When mining operations cease, a new equilibrium is gradually established. These readjustments, in response to gravity, may involve the slow creep of soil and subsoil or the swift precipitation of rock masses.

Landslides commonly include all downward movements, either slow or sudden, of mud, clay, gravel or stratified deposits. The problem presented by landslides together with their control or prevention, is of particular importance to opencast mining engineers and to mining engineers operating subsurface mines in mountainous regions.

In many regions, landslides are a serious problem to-day because of the increasing scale of mining operations. Opencast excavations tend to become deeper and more extensive and these factors in conjunction with heavy blasting and the movement of heavy machinery are liable to initiate earth movements.

In many cases, the slide is initiated or at least aided, by the fact that the soil and strata have become waterlogged and form mobile horizons along which slippage and flowage can occur. These factors, singly or in combination, may be just sufficient to upset the stability of deposits already heavily strained. A sharp period of heavy rainfall, with its added weight of water and lubricating action, may act as the trigger which sets off the sudden movement. The existence of earth-stress within the hillside rock masses or the action of earth tremors may, in some cases, induce downhill movements.

## EARTH MOVEMENT IN NARROW VALLEYS

Landslides are familiar troubles in many areas where open pits or shafts are located along narrow valleys. For example, in parts of Wales, such as the Rhondda, Merthyr and Rhymney valleys, the coal mines are necessarily situated along the narrow base of the V-shaped valleys and the mountain slopes converge steeply. In such geologic-topographical conditions, the menace of rock falls or landslides is ever-present. The area is commonly associated with large expanses of gathering ground for rain water which tends to convert the shales and fireclays into soapy lubricants and these play a dominant role in the genesis of landslides in the Welsh valleys.

The preliminary indication of a landslide is usually soil creep, but the movement is so slow that it may continue for a long period without detection.

The character of a slide and its magnitude appears to depend upon many factors, the most important of which are the depth and shape of any open pit workings, the number and attitude of the incompetent beds, bedding planes, fault zones and joints and the composition, physical character and shearing strength of the deposits. In the

case of open pits, the method of mining, rate of advance, vibrations from heavy blasting and the use of heavy machinery are contributing factors.

Where opencast workings are developed in flat or gently inclined strata, possible joints and faults are often controlling factors, but in more steeply inclined formations, movement commonly occurs along bedding planes should these dip towards the excavations. Landslides are always a danger on steep slopes, particularly where the underlying structural and lithological conditions are such as to permit the rather free development of sliding planes. Slippage may occur in deposits of hard rock by the intercalation of argillaceous beds or by fault zones inclined in the same direction as the slope of the land surface.

## EXCESSIVE SATURATION

Excessive saturation of the strata must be viewed as an important cause, if not as a deciding factor, in the development of landslides. A large number have been caused by the slippage of pervious beds over impervious beds where a high degree of saturation has been attained. Unconsolidated deposits near the surface, in the presence of more water than is necessary to fill the pore spaces, may flash into a liquid state and rush downwards into the workings.

Mine pumping, which effects a change in the water table contours, may weaken the contiguous rocks by dissolving and loosening their more soluble minerals, especially in areas where the ground water contains much  $\text{CO}_2$  or organic acids. Deep open-pit excavations at the foot of a mountain may unbalance the stability of the rock masses owing to the removal of support at the base.

During mining operations in regions liable to landslides, data regarding the angle of repose, angle of slide and excavation deformation of the local deposits are of considerable practical value. In the case of debris, composed mainly of shales and clays, the angle of repose is commonly between 30 deg. and 35 deg. In shovel operations, where blasting on successive benches of the bank produces granular material lacking mass cohesion, the angle of repose is about 45 deg. Some fireclays and shales will slake down with ease and are apt to slide as readily as clays; when this occurs movement may be initiated on very low slopes.

## ROCK FALLS AND SLIPS

A rock of high crushing strength, such as granite or massive sandstone, will stand with a face that is practically vertical without shearing or slipping. A similar formation intersected by fractures or other planes of weakness, will release fragments from steep slopes until a certain angle of permanent repose is attained. The resistance to slip arises partly from the friction between the grains of the material and partly from their mutual cohesion. Friction is, however, the only force which can be relied upon for permanent stability, as the force of adhesion may be destroyed



by the action of air or moisture, particularly during alternate frost and thaw.

When hard massive rocks, such as sandstones, are exposed on hill slopes, the hillside may be safe and stable at all angles up to the vertical. On the other hand, a hillside consisting of bedded rocks may be liable to enormous rock falls. The deciding factors are the degree and direction of dip in relation to the hill slope and the nature of the rock sheets. If the deposits consist of alternate hard and soft beds, there is always a tendency for relative movement which may initiate and propagate a general downhill movement. Quarrying and opencast operations are frequently responsible for rock falls.

If rock formations dip into the hill, conditions are normally favourable for stable hillsides. The structure may, however, be deceptive if a system of joint planes is present and inclined at roughly right angles to the stratification. Occasionally, master joints develop a perfect plane owing to the tendency of the overlying deposits to slide clear and afford a free outfall.

The rock and soil slip type of landslide is largely confined to structures where the strata possess a pronounced dip in the same direction as the hillside of which they form a part. As before, the trouble generally begins after a very rainy period. In a structure of this type slipping movements may be induced along the bedding planes of the impervious shales and fireclays. The water percolates through the sandstones and is not only deflected by the fireclays but converts the beds into soapy slipping planes. If the angle of dip and the water content are sufficient, the superincumbent masses will slide downhill with devastating results. A number of opencast sites have been overwhelmed in this way.

#### EARTH AND MUD CREEPS

These landslides are not well defined and necessarily embrace some complex movements. The group includes those slow creeping slides of soil or other superficial material which rarely cause loss of life but often demolish mine erections and sidings in their path. The tendency to slide is so active in some cases that a drag is exerted on the underlying beds. This creep usually develops in the incompetent beds and is often seen in steeply tilted strata that outcrop on abrupt surface slopes. This structure, sometimes known as "terminal creep" is of considerable importance to the mining engineer when seeking sites for impounding water and other hydraulic problems. The impounded water would saturate the incoherent deposits, lower their angle of repose and cause them to slide and flow downhill.

Earth and mud creeps may also be sudden and of a violent character. The angle of slope of the slipping planes may not necessarily be steep or the mass necessarily high above the valley.

A certain large slide of soil, subsoil and rock was set in motion by a deep cutting to receive a retaining wall for mine wagon roads. The mass of soil and rock flowed forward and downward and undermined the wall and railway lines.

#### EARTH SLIDES

Landslides of this type are commonly associated with high banks, moderate to steep slopes, incoherent material and high water content. The rate of movement is usually erratic; sometimes slow while at other times it may amount to several feet daily. The downward movement of the mass is frequently accompanied by the upheaval of the ground in the vicinity of the excavation.

Landslides of a compound character are common in

many mining areas. Initially, the movement may be soil creep, but the accumulating weight and momentum tend eventually to initiate a general movement of the whole mass, often down to a considerable depth. The final result is that the whole mass of soil and strata move downhill in the form of a combined soil creep and rock slips.

These two contributory factors, the downward movement of the mass accompanied by ground upheaval and the momentum initially caused by soil creep, have each been responsible for serious landslides in Welsh valleys.

#### EFFECT OF MINING SUBSIDENCE AND SPOIL HEAPS

A complicated series of phenomena result when landslides are associated with subsidence caused by underground workings. In fact, it is probable that in many cases landslides and surface subsidence have been confused and compensation for surface damage has been paid by mining companies for destruction wrought by landslides. Consequently, in mining regions, the problem of landslides is one which presents itself in different forms and the damage may be due to a combination of forces—landslides and subsidence.

In the absence of palpable evidence, mine spoil heaps are rarely the cause of landslides. If the slope on which the mine debris is deposited is sufficiently stable initially to sustain the material, in the first place, the additional weight should not cause the hillside mass to become unstable. Normally, the additional downhill pressure, due to the weight of the spoil should be offset by the additional friction between the supporting surface and the base of the spoil heap.

However, if the seat or floor of the heap is itself unstable, due to other causes and before dumping was commenced, then the extra weight of the debris on the already unstable base, will tend to accelerate any downhill movement of the ground underneath and consequently of the spoil heap itself. In this case, the centre of gravity of the mass would be modified resulting in a pushing movement which would accelerate the downhill slide of the base and of the heap itself.

#### SOME PREVENTATIVE MEASURES

In some cases, active landslides have been arrested by freezing. To minimize movement, the usual expedients are the planting of shrubs and more particularly the drainage of water from the slipping planes. When a mine is opened in an area liable to landslides, movements have ceased or become less frequent, due to the seepage of the ground water, through subsidence breaks, into the mine workings. When drainage is adopted as a preventative measure, a trunk tunnel is sometimes driven into the hillside with lateral tunnels to intersect the clay or other deposit forming the sliding plane. The radial or lateral tunnels are driven to cover the whole danger area. When the ground water is successfully tapped and drained, the menace of mass slides is materially reduced.

In the case of active landslides, a number of shallow staple pits may be sunk through the unstable mass until the sliding plane is intersected when large volumes of water are usually tapped. These pits are connected by large drains which are usually effective in arresting further movement. Drains are sometimes constructed along both sides of the landslide mass and a set of cross drains put in to tap all possible sources of water.

Elaborate preventative measures, such as drainage schemes, are seldom justified except at sites where sinkings have already commenced or where a more favourable location is not available.



## New Granby Type Mine Cars For Canada

To satisfy the unusually severe underground conditions existing in certain mines of a large Canadian organization Robert Hudson Ltd. built several Granby type mine cars, the strongest yet designed by the company.

The extremely rugged construction of these cars was necessary because the ore to be hauled was of high density, namely 16 cu. ft. per ton, was abrasive and, moreover, was loaded as it was mined with rocks of up to one ton in mass. Loading was by slushers working in scam drifts or from chutes. In addition to the difficult conditions



The new Granby mine car

afforded by the mass and large fragmentation of the ore, moisture was prevalent with an appreciable corrosive action exercised on the steel by sulphides. Haulage was by electric locomotive and further rough usage came from the cars being dumped by means of a hump-backed ramp whilst in motion.

The new design was evolved to deal with these tough operating conditions and at the same time to counteract the splaying tendency to which the usual design of this type of mine car is subject. Splaying arises because Granby cars are built in the form of a three-sided box, the fourth side being the door of the car and having no rigid connections with the two ends. A tendency therefore exists for the ends to splay outwards under severe loading conditions, and should this occur to any serious degree the free operation of the door would be interfered with and the risk of derailment at the loading point would arise.

### NEW DESIGN AND CONSTRUCTION

These traditional problems, together with the need to construct an extremely rugged unit capable of meeting the conditions described, promoted the design and manufacture of the new Granby type mine car. The unit has a body capacity of 110 cu. ft. and stands in overall dimensions at 5 ft. 4 in. high, 11 ft. 8 in. long and 4 ft. 10 in. wide, with body dimensions of 8 ft. 8 in. in length, 3 ft. 1½ in. in depth and a rail gauge of 3 ft. Each car weighs 11,900 lb.

The body plates are of M.T.K. quality steel supplied by the Appleby-Frodingham Steel Co. Ltd. having a tensile strength of 33-38 tons p.s.i. and a copper content of 0.5 per cent. The main plate is constructed in one piece and forms the bottoms and the ends of the car with well rounded transverse corners. This plate is ¾ in. thick and is reinforced by continuous channels welded on toes to the plate to form strong box sections which are designed to resist the end

splaying tendency. The back and door plates are 5/16th in. thick and are similarly reinforced.

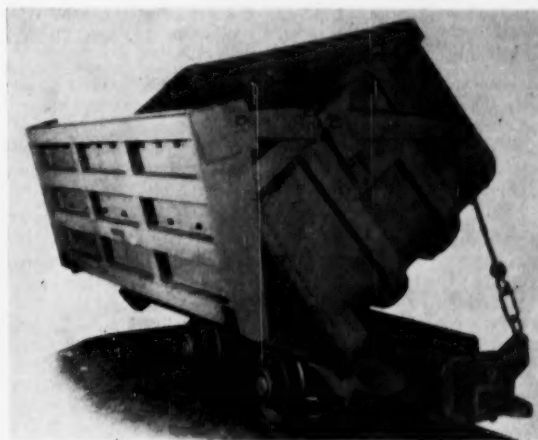
To cushion loading shocks, and thereby to reduce damage and wear to the main plates, a timber liner 1½ in. and a steel liner ¾ in. in thickness are secured to the body bottom. In addition steel liner plates ¾ in. thick are provided on the door, the fixed side and the two ends. All liner plates are renewable and a longitudinal back corner liner is provided which, in conjunction with the rounded transverse corners, minimizes the possibility of any build-up of fines.

It has been found that a peening action is set up on the bottom liner plate from the constant severe blows encountered in the loading operation, and to counteract this a number of anti-peening bars of 5 in. x 1½ in. section are welded to that plate. Care has been taken to avoid pockets or other obstructions to discharge by running out these into the back corner liner.

The door of the car is of the swinging type to avoid restriction of the free passage of large rocks. The door is held in the closed position by massive cast steel book type door holders well secured to the body ends. The door arms are of 1½ in. thick M.T.K. steel and the main and door pivot pins, which are in double shear, are of ample proportions and work in phosphor bronze bushes provided with grease gun lubricating nipples.

### NO HINGE LOAD

Special attention has been paid to the design of the body hinges. These are four in number and are manufactured in cast steel. The pins are 2 in. dia. Each top bracket is provided with a phosphor bronze bush, a grease reservoir and a grease gun lubricating nipple. The design is such that under running conditions no load is carried on the hinges and consequently these are only subject to wear during the dumping operation.



The car in tilt position

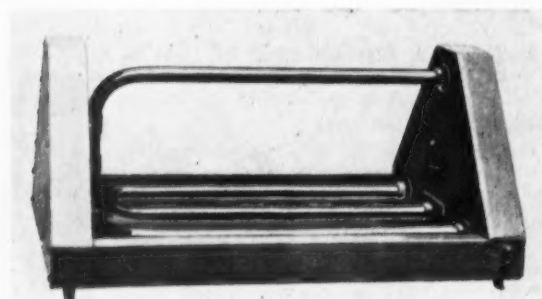
To withstand the severe conditions of loading, of buffing, and the excessive corrosion, the main frame is in the form of a one-piece substantial steel casting weighing approximately 2,000 lb.

Following Canadian practice, the wheels are of chilled cast iron, and each is equipped with two Timken tapered roller bearings No. 759-752 and an efficient synthetic rubber grease seal arrangement.

## MACHINERY AND EQUIPMENT

### Electronic Detection of Tramp Metal

Any material in which the presence of tramp iron is injurious to the end product can be examined automatically to ensure freedom from contamination by use of the electronic metal detection equipment manufactured by Metal Detection Ltd. The value of these equipments in the crusher houses of mines is therefore easily envisaged in connection with the removal of such tramp iron as broken drill steel or bits from conveyor-borne ores. Indeed, the tramp metal may be either ferrous or non-ferrous as detection does not depend on magnetic properties, while the processed material may have a high moisture content.



The type HD 9 search coil unit

The HD 9 electronic metal detector is suited to the clearance of tramp iron from such materials as coal, limestone, slag, granites, etc., and the material may be fed through the search coil aperture by conveyor, chute, pipe, or other handling unit.

The equipment consists of a search coil unit and a control unit, together with auxiliary apparatus for the rejection of contaminated material and for alarms. The control unit is of standard design for all applications, while the search coil is specifically designed for each installation and consists of two sections. Two basic types of coil are available, the type HD for use in mines, quarries, etc., and the LD for lighter applications.

In operation, a high frequency electro-magnetic field is set up by the search coil. When metal passes through the search head the field is distorted and a signal induced into a second coil. This signal is passed to the control unit, amplified and used to operate relays controlling the alarm or reject systems. Special circuits are incorporated to minimize the effects of temperature and supply voltage changes.

The HD 9 unit operates from 110 to 230 volts, 50 cycle, with a power consumption of less than 150 watts. Voltage variations of -15 per cent to +10 per cent are automatically compensated. There is no reasonable limit on the separation of the two units so long as distances greater than 30 ft. are specially considered. The minimum detectable particle depends on the material processed and on the type of metal, but may be as little as one milligram. The control unit weighs approximately 100 lb., and is 2 ft. wide by 15 in. deep by 3 ft. high.

### Voice Transmission System for Mine Operations

The installation of a frequency-modulated voice transmission system has solved the problem of dispatcher-motormen communications at the Beech Bottom Mine of the Windsor Power House Coal Company, United States. The F-M system serves to maintain continuity of trip movements and assures maximum safety for personnel in the operation of mine locomotives.

With this system, the dispatcher is in continuous voice contact with six key mine locomotives that operate throughout the mine picking up loaded trips from the three sections

currently being worked. The dispatcher's office is centrally located in the mine and the dispatcher keeps the five locomotives, equipped with MSA Mine Phones, moving four-ton coal cars from butt entries to a collecting point in the main haulage where a 20-ton tandem locomotive, similarly equipped, takes over and delivers the cars to the dumping point.

Use of the voice transmission system prevents interruptions to production because it is no longer necessary for a motorman to stop on each trip to telephone the dispatcher for orders, as the dispatcher now can contact any of the six motormen without waiting for them to call in by telephone. The Mine Phone has prevented costly delays at the working face by the speedy transmission of information about machinery breakdowns.

The Beech Bottom mine is equipped with 500 cars which travel through the main haulageway, approximately seven miles long. The transmitted messages have eliminated traffic jams. Motormen can hear the dispatcher simultaneously over the speakers on their locomotives, and they are aware of the orders given to the others and can report immediately any condition that may necessitate emergency action.

Little maintenance has been required for the phone system since its installation. A dust-tight steel box houses the receiver and transmitter units on the locomotives. Both units are shock-mounted to avoid damage to tubes and parts. The equipment is compactly housed and takes up little space on the locomotive. The Mine Phone operates with power taken directly off the trolley wire.

### Disc Type Impact Idlers

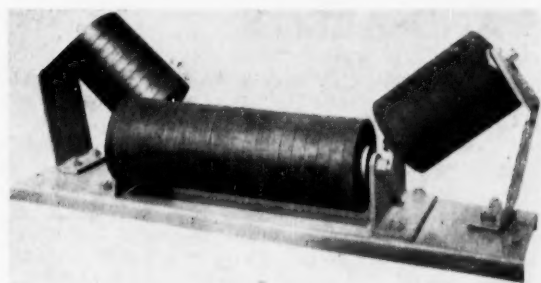
A new type of rubber impact idler has been developed by Richard Sutcliffe Limited and their associate company The Sutcliffe Moulded Rubber Company Limited. The original type of impact idler was introduced in 1948 and its belt preserving properties have now been fully proved.



The roller components

The new type has two main advantages over the old type. Firstly, that every individual item can be replaced if necessary, making overhaul and repair a simple matter, and secondly that a smooth surface is presented to the belt instead of a grooved surface which tended to clog with fine material. The controlled deflection, which was the purpose of the grooves, is provided on the new type by a number of air pockets within the body of the roller.

The roller is made up of a number of moulded rubber discs 7 in. outside diameter, which are fitted to a 3 in. diameter steel shell. At each end of the roller a retaining ring and circlip lock the discs under slight pressure. The discs are shaped so that an air pocket is formed between each of the mating surfaces.



The assembled disc-type impact idler

The zinc alloy end disc which houses the 1 in. diameter ball bearing is designed so that the rubber sealing ring, bearing, distance piece, washer and circlip can all be removed and any item replaced. The complete roller is fully interchangeable with the old type.

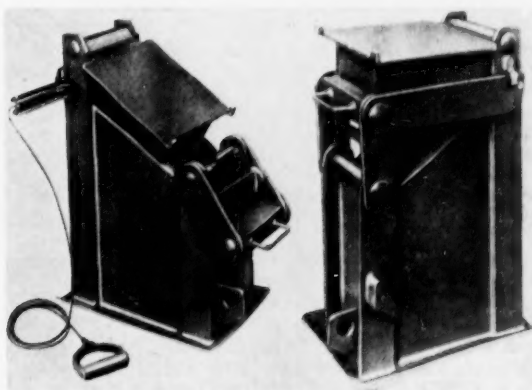
#### An Insulated Electrode Holder

For some time the Lincoln-Jackson Heavy Duty Holder manufactured by Lincoln Electric Co. Ltd. has achieved success in the United States. The tool is claimed to be economical and spare parts are easily obtained and replaceable. Designated the A-35 electrode holder, the tool is available to the welding operative. It is insulated throughout and is manufactured in superior copper alloy. Complete protection is guaranteed from accidental arching, while the insulated crown channel type jaws provide more heat-resistivity and durability. The holder keeps cool while the welding operation is in progress. The A-35 has a tensile strength of 35 tons, a Rockwell hardness B of 125 V.P.H. and an electrical conductivity of 35 per cent.

#### A Steel Stool Safety Chock

The Gofar Stool Chock designed and manufactured by Hill Porter (Newcastle) Ltd., and distributed by their associate company, Electricals Ltd., has been designed to reduce the time required to move forward roof supports in a mine and to release easily and safely by remote control with a light hand pull. The chock can be set quickly and it is impossible to pre-release it by falling debris or vibration. The importance of the chock as a safety factor in underground operations is therefore obvious.

The chock consists essentially of three parts, namely the base member, the platform and the release mechanism. The base member is fabricated in a box-form construction, incorporating the bearings for the platform and the bearings for the release mechanism. The platform, also in box-form construction, is hinged on the back to the base member and the front of it rests on the release mechanism. This release mechanism consists of



The Gofar chock. At left tripped and at right in the set position

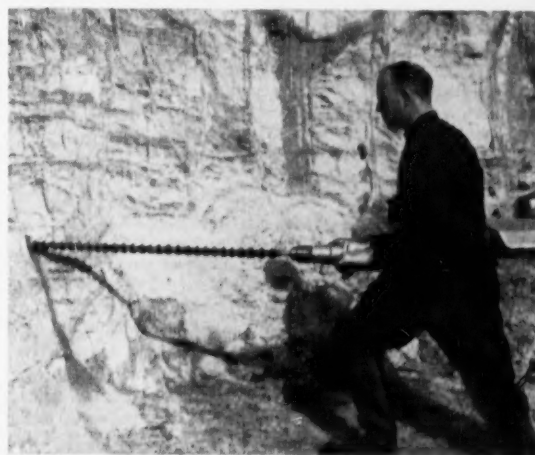
two levers fixed together and hinged at their lower ends, while at the upper ends a cross-piece of square cross-section is pivoted to them. Fixed to the cross-piece is a lever held horizontally by a pin passing through its outer end when the chock is set. The front of the platform rests on the square cross-piece and as the transmitted load is made off-set to the axis of the cross-piece the horizontal lever drops when the release pin is withdrawn from it. A cable is fixed to the release lever to enable the chock to be tripped safely from any position.

The platform drops and turns through an angle of about 35 deg. Each chock is tested up to a load of 50 tons.

The Gofar stool chock has a platform approximately 12 in. sq., a base approximately 16 in. x 12 in. and is available in heights from 16 in. upwards.

#### Rapid Drilling in Sandstone Face

By the use of a 4 ft. drill of 1½ in. diameter employed in conjunction with a Black and Decker Ltd. ½ in. Standard Drill a full depth hole was drilled into the surface of a Kent sandpit in approximately 90 seconds.



Standard equipment used in the sand pit

This operation was carried out in response to an enquiry as to the possibility of increasing the output of builder's sand from the pit by several hundred per cent. Representatives of Black and Decker Ltd. found the sand face to be 30 ft. high and having the appearance of sandstone. In fact, the face was so solid that a caterpillar grab tended to bounce back at each grab motion.

Six holes were drilled and blasted by means of the equipment described during a lunch hour, with the result that several hundred tons of sand were loosened into a huge landslide ready for rapid removal. The previous method of drilling was by hammering and rotating a piece of gas pipe by hand. This operation took approximately half a day per hole.

#### Scintillation Counters for Geological Use

A small, lightweight, portable scintillation counter for use in geological field work and in prospecting for radioactive material is described in a report recently released in the United States.

The counter was designed by scientists of the U.S. Geological Survey as part of a programme carried on by the Survey for the Atomic Energy Commission. The instrument weighs about 7 lb., stands about 12 in. high, and is commercially available from several manufacturers for about \$500. The outward design of the instrument was determined largely by a committee of field geologists, and the instrument has been used extensively by Survey geologists during the last two field seasons. The scintillation counter has been used with some modifications for making measurements in drill holes as much as 1,000 ft. deep.



## METALS, MINERALS AND ALLOYS

**COPPER.**—Copper has remained a firm market in New York with spot deals being made at small premiums over the 30 c. per lb. maintained by the big producers. Demand shows no sign of abating and the ability of the producers to hold 30 c. is remarkable. Not all observers, however, are convinced that they will be able to do so indefinitely especially if, as has been reported, the Chileans divert copper from New York to London. At the same time, apart from meeting contractual obligations, not a great deal of Chilean copper has been finding its way to New York of late and indeed the market there took little notice of the Chilean dock strike. Nevertheless, the report of bigger Chilean deliveries to Europe had a marked and immediate effect on the London price. It was particularly interesting that the report coincided with this week's comment by Mr. Prain on London and U.S. copper prices. If the Chileans are able to arbitrage in this way, the gap between the London and the New York (which Mr. Prain calls the world) price would thereby be narrowed, although it would still require a far greater volume of copper to pass through the L.M.E. to produce the necessary stability.

From Chile the news now is that the situation in the Valparaiso and San Antonio docks has returned to normal and the threatened strike of the merchant fleet has been averted. Following the withdrawal of the state of emergency in the mine areas, a new cabinet has been brought in. Senor Olavarría, who had maintained the emergency against the demands of Congress, has given way as Minister of the Interior to Senor Sergio Recabarren.

On the Copperbelt, the steady drift back to work of African strikers (predicted in these notes last week) has continued. At the present time all four mines are producing, if only on a limited scale, and Roan Antelope has never stopped production. On January 12, 2,074 Africans were engaged in normal mining work apart from those on essential duties which numbered over 2,000. The strike appears to be crumbling, but those remaining out are apparently becoming increasingly vigorous in their picketing methods.

The strike will embitter relations for some time to come; African strikers resent African blacklegs; the entire African population resents the action of the Executive Council of the European Union in permitting Europeans to do African's work during the strike; and European miners are divided among themselves on this very issue. In fact, the most disturbing aspect of the strike is that it sets the background against which the European Union will this month hold a compulsory ballot on the proposals of the Anglo American group for African advancement. The proposal is that border line jobs, identical jobs and a few simple European jobs should be given to the Africans at a rate which will ensure that at the end of five years the number of Africans advanced into the present European jobs should not exceed five per cent of the total employed at the three Anglo American mines on January 1, 1955. The companies guarantee that no Europeans will lose their jobs and that all consequential transfers will be to jobs of equal or more pay. A scheme for European advancement will also be introduced. It is not known whether the Union is offering any recommendation with the ballot paper.

**LEAD.**—Although demand in New York fell off slightly compared with the previous week it was also firm and at times fairly strong. The price of 15 c. per lb. was well maintained and appears in no danger so long as stockpiling continues. Automobile production last week was 27 per cent up on the same week of the previous year with the small independent manufacturers yet to get into their stride. Automobile production is in fact creeping up to the peak level of June 1950 and must create a substantial demand for batteries. Lead producers will also have been comforted by the amount of construction work promised in the President's message to Congress.

**TIN.**—With the New York price for Grade A tin hovering around 86 c. demand has been more active than for some time past although the market has been well supplied with tin by Continental dealers. The tinplate industry, while taking part in the general upswing of steelmaking, has not kept pace

with the advance in other sections. However, much better business has been booked of late for the entire first quarter of the year. Yet the stocks of tinplate producers are high and it will take some weeks of sustained keen demand to have any significant influence on the New York tin price.

From Indonesia it is reported that a state of emergency has been declared in the area of the Moluccas. It is not to be inferred from this announcement that the general Indonesian situation has got further out of hand for there is no evidence to that effect. At the same time it is not clear why the Government should have made the declaration now since intermittent fighting has proceeded for the past five years. The probable explanation is the Government's wish to establish order in its own house in view of its leading part in the forthcoming African-Asian conference and of its demand for controlling Dutch New Guinea. If this is the reason there is no ground for expecting a falling off in tin production or exports.

**ZINC.**—The American price at 11.50 c. per lb. East St. Louis was held firm in face of continuing steady demand especially from die casters and galvanizers. Zinc, like lead, should benefit from the President's encouragement of housing and other forms of construction. The industry has been heartened, too, by the continued steady fall in the stocks of zinc. During December producers stocks of refined zinc fell by 10,562 tons to 124,077 tons compared with the peak of 209,828 in May, 1954, and 180,843 at the end of 1953. At the same time all other figures emphasized the dependance of the metal (and its present price) on stockpiling, although the incidence of Christmas should not be forgotten. Zinc deliveries in December were down at 95,728 tons compared with 97,617 (revised) in November; 17,218 tons went to the stockpile, while deliveries to consumers at 75,105 were 2,000 tons down on November. On the other hand U.S. production continued to outstrip consumption and at 85,166 tons of refined metal was nearly 5,000 tons up on November and was the highest reached for many months past. Taking last year as a whole both U.S. production and consumption of slab zinc were at their lowest since 1949. Total deliveries in 1954 in fact rose to the highest level since 1950 but only because deliveries to the stockpile exceeded 12 per cent of total production.

**ALUMINIUM.**—Following the rise in Canadian and U.K. prices reported here last week, the New Year round of aluminium price increases has now been completed with a 1 c. per lb. advance by all the U.S. producers both for pig and ingot aluminium. Following the increase the U.S. domestic prices are respectively 21½ c. for pig and 23.2 c. for ingot metal. In terms of the new U.S. price Canadian and British consumers now have an advantage of more than 3 c. over U.S. consumers while Canadian metal is selling in the States at more than 2 c. below the new U.S. producers' price, duty paid. It remains to be seen how long this differential remains.

The recent price increase in this country has had no appreciable effect on the supply position here, which has in recent weeks continued to become tighter. The present tightness may, however, in part be due to exceptional stocking up towards the end of last year in anticipation of the price rise and some colour is lent to this view by the fact that there is at present no heavy pressure of forward buying for the coming months.

Reviewing the outlook for the aluminium industry last week, the president of the Reynolds Metal Co., Mr. R. S. Reynolds, Jr., forecast that new production records would again be broken this year for the fourth consecutive year in view of the new production capacity scheduled to come into operation, which he believed would result in further expansions in such major markets as construction, transportation, electrical equipment and packaging.

Mr. Reynolds indicated that U.S. output of primary aluminum in 1954 had been in the neighbourhood of 1,450,000 tons, an increase of about 16 per cent over 1953. Shipments of aluminium mill products were, at the end of the year, running at a level of about 23 per cent above the rate at the beginning of the year, while during the corresponding period the general business index had only recorded an increase of 5 per cent. These figures are particularly significant if we recall



that, at any rate, during the first half of 1954 American markets were to say the least uncertain.

It would appear that plans to go ahead with the French aluminium plant in the Cameroons have now been finalized. The enterprise will be operated by the *Compagnie Camerounaise de l'Aluminium Pechiney-Ugine (ALUCAM)* jointly set up by the two big French aluminium producers, Pechiney and Ugine, in collaboration with the Cameroons administration and the Caisse Centrale de la France d'Outre-Mer. A plant is to be established at Edéa which will process alumina from metropolitan France and is to have a scheduled capacity of between 45,000 and 50,000 tonnes, a capacity which is expected to be reached by 1959. Meanwhile, an initial production of about 8,000 tonnes is planned for 1956. This whole scheme is apparently at present regarded by the French as no more than an interim one, and there is talk of eventually stepping up aluminium production in the Cameroons to 100,000 tonnes based on bauxite supplies from French Guinea.

**ASBESTOS.** The outlook for asbestos in 1955 is very good from a fibre use standpoint, according to the Philadelphia organ, *Asbestos*, in the latest release of which the foregoing comment is given perspective by the additional remark that U.S. demand in 1955 will equal, or slightly exceed, the current year's figure.

**MANGANESE.**—Union Carbide and Carbon's Electro-Metallurgical Co. has started production of 99.9 per cent pure manganese metal in the form of plates at a new plant in Marietta, Ohio. In making this announcement, the company also stated that the new plant will have a capacity of about 6,000 tons annually when in full production, and the pure manganese will make it possible for steel companies to produce newly-developed manganese-chromium stainless steels which require less nickel.

**TUNGSTEN.**—The first of the South Korean Government's auctions of wolfram (250 tons was on offer) has been held in Seoul and resulted in no tenders being received. The Ministry of Commerce and Industry is reported as not having anticipated any business from this auction but to be expecting to receive bids from the auctions that are being held simultaneously in London and Washington.

The wolfram deposits discovered by the Turkish Geological Institute on the Ulu-dag, near Broussa (see this column November 19), are to be worked by the Turkish Eti Bank. The average tungsten content is stated to be around 0.5 per cent and some parts to be as high as 1 per cent.

Tungsten ore prices continue to rise. The British Government selling price of standard grade having been raised twice in the past five days, now stands at 211s. per l.t.u. delivered consumer's works both for wolframite and scheelite. Prices are also up in New York with foreign ore now quoted at \$26/26½ s.t.u.

## The London Metal Market

(From Our Metal Exchange Correspondent)

Nothing outstanding has happened in the tin market, and values have been inclined to drift downwards in view of the anticipated further easiness in the supply position. It is still not known whether France will finally ratify the International Tin Agreement, but it is understood that a bill for this purpose will be introduced to the National Assembly but is not expected to be debated for two or three weeks. It is likely to have a difficult passage. On Thursday morning the Eastern price was equivalent to £699 per ton c.i.f. Europe.

Some violent fluctuations have occurred in copper quotations, which, after reaching well over £300 per ton for the cash position, have reacted sharply to under £290 for that position with corresponding movements in the forward quotation. The setback has been brought about partly by the settlement of the Chilean dock dispute but chiefly by the report circulated by Reuter on Wednesday that the Chilean government would divert copper to the London market in view of the better price obtainable here than in the U.S.A. European demand for electrolytic copper has continued at a high level.

Lead has not maintained the highest quotations recently seen, but the tone generally is quite good and consumption

continues at a satisfactory rate. The backwardation has disappeared at any rate for the time being and a contango has been established between the first and second half of January, no doubt caused by the approach of the half-monthly settlement.

The zinc market has had a rather better tone and there seems to be a good demand for current month metal. High-grade zinc supplies are very tight, and some considerable premiums have been paid for these grades for early shipment from the Continent.

Closing prices and turnovers are given in the following table:—

	January 6		January 13	
	Buyers	Sellers	Buyers	Sellers
<b>Tin</b>				
Cash .....	£684	£685	£694	£695
Three months .....	£688	£689	£694	£695
Settlement .....	£685		£695	
Week's turnover .....	790 tons (9 days)		325 tons	
<b>Lead</b>				
Current half month .....	£104½	£105	£103½	£103½
Three months .....	£103½	£104	£103½	£103½
Week's turnover .....	4,225 tons (9 days)		2,300 tons	
<b>Zinc</b>				
Current half month .....	£84½	£84½	£85	£85½
Three months .....	£83	£83½	£83½	£83½
Week's turnover .....	6,325 tons (9 days)		3,475 tons	
<b>Copper</b>				
Cash .....	£297	£298	£294	£295
Three months .....	£279	£280	£277	£278
Settlement .....	£298		£295	
Week's turnover .....	6,775 tons (9 days)		4,700 tons	

## OTHER LONDON PRICES—JANUARY 13

### ANTIMONY

English (99%) delivered,	
10 cwt. and over ... ..	£210 per ton
Crude (70%) ... ..	£200 per ton
Ore (60% basis) ... ..	22s./24s. nom. per unit, c.i.f.

### NICKEL

99.5% (home trade) ... ..	£519 per ton
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### OTHER METALS

Aluminium, 99.5%, £163 per ton	Osmium, £46 oz. nom.
Bismuth	Palladium, £6 15s. oz.
(min. 2 cwt. lots) 16s. lb.	Platinum, £30/£31
Cadmium (Empire), nominal	Rhodium, £43 10s. oz.
Chromium, 6s. 5d./7s. lb.	Ruthenium, £22 oz.
Cobalt, 21s. lb.	Quicksilver, £110
Gold, 251s. 6½d. f.o.z.	ex-warehouse
Iridium, £39 oz. nom.	Selenium, 35s. 9d. nom.
Magnesium, 2s. 4d. lb.	per lb.
Manganese Metal (96%-98%)	Silver, 74½d. f.o.z. spot and
£225/£262	74d. f.d.
Osmiridium, £40 oz. nom.	Tellurium, 15s./16s. lb.

### ORES, ALLOYS, ETC.

Bismuth ... ..	60% 8s. 3d. lb. c.i.f.
Chrome Ore—	50% 7s. 3d. lb. c.i.f.
Rhodesian Metallurgical (semi-friable) 48%	£12 12s. 6d. per ton c.i.f.
.. Refractory 45%	£12 5s. 0d. per ton c.i.f.
.. Smalls 42%	£8 17s. 6d. per ton c.i.f.
Baluchistan Metallurgical	£13 5s. per ton c.i.f.
Magnesite, ground calcined	£26-£27 d/d
Magnesite, Raw	£10-£11 d/d
Molybdenite (85% basis)	105s. 3d.-108s. 1d. per unit c.i.f.
Wolfram and Scheelite (65%)	196s. 0d./200s. 0d. - U.K.*
	Gov't Stock d/d 210s. plus charges
Tungsten Metal Powder (98% Min. W.)	17s. 3d. nom. per lb. (home)
Ferro-tungsten	14s. 3d. nom. per lb. (home)
Carbide, 4-cwt. lots	£37 6s. 3d. d/d per ton
Ferro-manganese, home	£54 15s. 0d. per ton
Manganese Ore Indian c.i.f.	
Europe (46%-48%)	66d./68d. per unit nom.
Brass Wire	2s. 10½d. per lb. basis
Brass Tubes, solid drawn	2s. 3d. per lb. basis

\* Ex-government stock for prompt delivery from January 14



## COMPANY NEWS AND VIEWS

### "Johnnies" December Quarterlies

The first of the quarterly reports covering the final period of the year 1954 has come from the Johannesburg Consolidated Investment Company. Of particular interest amongst these was that from Randfontein which disclosed that the expansion of the uranium plant is now practically completed. Profits from uranium during the quarter, after provision for interest on and repayment of loan for the project amounted to £641,000. Yet, as the rate of production of uranium oxide is being increased as additional ore from the Bird Reef becomes available for treatment, there may be further scope for increased profits. In addition, when this big plant becomes fully run in, there should be still further improvements.

Mining operations on the Bird Reef series are being further extended and the tonnage of ore being mined and treated from the Main Reef and other horizons will continue to decline as labour is transferred to the Bird Reef workings. Of the quarter's development footage of 26,302 ft., 22,077 ft. were on the Bird Reef horizon. Of the remaining 2,565 ft. which was sampled for gold, 1,010 ft. was payable having an average value of 5.7 dwt. over 50 in. Ore reserves at the year end on gold bearing reefs amounted to 2,200,000 tons with an average value of 3.4 dwt. over a stoping width of 51 in. In addition ore reserves have been established on the Bird Reef horizon which are estimated to be payable on account of combined gold and uranium content.

From Freddie's Consolidated was announced the first estimate of ore reserves. These amounted to 815,000 tons with a value of 4.2 dwt. over a stoping width of 44 in. Development footage payable fell somewhat from the previous quarter to 2,145 ft. as against 2,290 ft. previously. Values also declined to 296 in. dwt. from 334 in. dwt. while the percentage payability was also down to 65.90 per cent from 74 per cent. It was reported that the length of stope face available remained inadequate. Moreover, the value of such stopes as are available declined during the past quarter with a consequent increase in working losses. A high rate of development therefore continues with the object of providing sufficient stope faces to enable an increased tonnage to be milled. This would also allow mining to be carried out on a more selective basis than is at present possible.

At East Champ d'Or all of the 5,959 ft. developed was accomplished on the Bird Reef horizon. This compares with the previous quarter during which a total of 5,519 ft. was developed but only 160 ft. was sampled for gold. Ore reserves on reefs valued at their gold content only were estimated at 34,000 tons with an average value of 4.5 dwt. over a stoping width of 4.5 in. In addition, as for Randfontein, payable gold-uranium reserves have been established on the Bird Reef horizon. Government Gold Mining Areas reported that the performance of the pyrite recovery plant continues to improve.

### Labour Troubles at Lake George

When the chairman of Lake George Mining Corporation, Mr. R. M. P. Preston, addressed shareholders at the meeting of the company in January last year, he referred to the shadow of seemingly endless labour troubles. These words are still applicable to-day, for due to the deadlock which exists between labour and management at the mine, operations have remained at a standstill since June 25, 1954.

However, despite the disappointments encountered in all negotiations, the outlook is now perhaps more hopeful. Mr. Preston referred to the fact that the bulk of men want to get back to work. There has been another mass meeting of the men at Captain's Flat on January 9 which had an exceptionally large attendance. After three hours of discussion, it was agreed that the management and men should meet and endeavour to reach agreement on all points in dispute. All matters which were not agreed at this meeting would then be referred to the Arbitration Court. While giving a warning against undue optimism, Mr. Preston hoped that if the proposed discussions are finally successful, the mine may be able to re-open for limited development work about the end of January.

### Burma Corporation Announces Maiden Dividend of 1½ Per Cent.

A maiden dividend of 1½ per cent, free of Burma income tax, has been announced by the Burma Corporation (1951) in respect of the year ended June 30, 1954. As previously disclosed, an outstanding recovery was made during the year and

profits after tax to June 30 were estimated at £270,997, after tax and depreciation, as compared with the previous year's loss of £198,348. The corporation is owned equally by Burma Mines and the Burma Government.

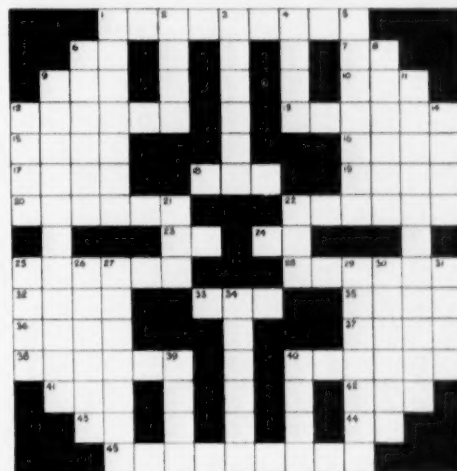
Some details of the corporation's activities during the first quarter of the current financial year were published in last week's issue of the *Mining Journal*, page 20. These figures showed that apart from the increasing liability for taxation due to the absorption of tax credits which resulted from previous losses, profits were well maintained at £165,000 as against £180,660 in the previous quarter which ended on June 30. There were useful increases in the production of marketable metals.

Unfortunately, these good results were attributed to the last quarter of the company's financial year which ended on June 30, 1954, whereas, in fact, they should have referred to the first quarter of the company's current financial year namely, the three months ended September 30, 1954.

### Increased Ore Shipments from Esperanza's Cyprus Properties

High grade cupreous pyrites ore shipments by the Cyprus Sulphur and Copper Company, the operating company of the Esperanza Copper and Sulphur Company, during the year ended March 31, 1954, rose to 31,750 tons as against 26,569 tons in the preceding year. Trading profits earned by the company were £99,063 as compared with £145,746 previously. After expenses the net profit fell to £65,720 from £122,851 but the balance carried forward was slightly improved at £93,609.

During the year production from the Kinousa Mine amounted to 51,039 tons of ore. It was stated that owing to the possibility of any pillars left behind being subject to spontaneous combustion, it was necessary to extract the ore completely as



**ACROSS.**—1. Usually an unpopular fellow. 6. Most teachers have this. 7. A polished finish. 9. To deride (less a K). 10. The piper's son. 12. Indian Ruler. 13. Red. 15. Prevaricator (confused). 16. Literary or Artistic style, without Commanding Officer. 17. Besides. 18. To this is human. 19. The lathe will do it. 20. Wrong shape. 22. Help wanted—twice. 23. The apprentice queries the question. 24. Passed. 25. The apprentice looks after this. 28. Accustoms. 32. Shades of Tommy Handley. 33. You get this by degrees. 35. Speck. 36. Leaf-like organ less 500. 37. S.A. Dutchman. 38. Medieval System. 40. Modern French playwright. 41. Almost a White Christmas. 42. Beers without an E. 43. A Congress less the C. 44. Years without an A. 45. For checking outside diameters.

**DOWN.**—1. Well known car—going backwards. 2. Journey. 3. Skilled Tradesman. 4. This can be woven—in reverse. 5. Containers for replies. 6. Bog. 8. Badly cast. 9. There are thousands of them here. 11. For precision measurement. 12. Eastern Country. 14. Distinguished persons. 21. This across is Tom. 22. For Winter sport. 25. Lovers often have this. 26. Total. 27. Impartiality. 29. Offence. 30. To support. 31. Catch of gun-lock. 34. A film actress made this famous. 39. Like Pharaoh's Cattle. 40. The Elephant Boy.

Solution on page 50



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mining proceeded. Ore below shipping grade was therefore dumped at the surface where it will be available for future treatment. As at September 1, 1954, Kinousa ore reserves were slightly down from the previous year's figure to 268,400 tons from 323,790 tons. This tonnage had a content of 1.97 per cent Cu. (2.37 per cent Cu.), 2.76 per cent Zn. (3.37 per cent Zn.) and 43.81 per cent S (43.63 per cent S.)

At the Limni Mine, 1,472 l.tons. of high grade ore was mined on the 19 ft. level and D.H. 49 areas, but all underground work was suspended in September to avoid interference with stripping operations in the opencast pit. In fact, the stripping of overburden which was started in August totalled 67,310 cu. yd. Ore reserves at this mine remained unchanged at 5,741,400 l.tons.

It will be recalled that the latest quarterly progress report issued on November 2, 1954, on behalf of the Cyprus Sulphur and Copper Company for the period ended September 30, 1954, announced that the water supply question—which had previously presented a difficult problem—had been satisfactorily settled. Accordingly, operations on Limni ore at the new treatment plant which is complete were expected to begin at the end of November. It was also disclosed that in the meantime a considerable amount of work had been done in the Limni Opencast to ensure continuous production and preparations at that time were well ahead of future mill requirements. The report also disclosed that shipments of Kinousa ore for the six months ended September 30 totalled 14,450 tons added to which shipments were continuing to meet contract obligations.

At the meeting of Esperanza which will be held in London on January 28, much interest will be shown in any statement Mr. A. Hedlev Williams, the chairman, may give regarding the progress which has been made since November. In particular, any information as to whether the Limni treatment plant is operating satisfactorily will be of interest.

#### Rambutan Raises Output and Increases Dividend

The fall in the price of tin ore sold by Rambutan during the year ended June 30, 1954, was more than adequately offset by higher productivity, lower costs and a sharp improvement in the grade of ground treated.

Year to June 30	Treated (cu. yd.)	Per cu. yard Yield lb.	Cost s. d.	Output (tons)	Price rec'd.* per ton £
1954	469,500	.75	1 9	156	403
1953	301,500	.60	2 7	80	516

\* Less tribute

In contrast with past years the greatest tonnage of tin ore came from the company's paddock Z which, although only fully developed since 1950, produced nearly 97 tons. This output was recovered from a total of 341,750 cu. yd. treated, well over double the previous figure of 134,100 cu. yd. Moreover, the grade obtained showed a sharp rise to .64 lb. per cu. yd. from only .28 lb. On the other hand, only 72,950 cu. yd. were treated at paddock Y (which for many years had represented the major part of the company's operations) as against 167,400 cu. yd. in the preceding period. Tin ore output in this section fell to 36 tons from 63½ tons. The grade recovered, however, rose from .85 lb. per cu. yd. to the exceptionally high level of 1.11 lb. per cu. yd.

Year to June 30	Gross Revenue £	Tax- ation £	Net Profit £	Divi- dends £	To Reserve £	Carry Forward £
1954	83,980	14,826	11,063	6,188	Nil	14,103
1953	68,969	9,265	9,301	4,688	2,000	12,429

Dividends on the issued ordinary capital of £100,000 in shares of £1 each were raised to 11½ per cent from 8½ per cent.

Furthermore, an interim of 7½ per cent has already been paid in respect of the current financial year to June 30, 1955, and although this payment, which compares with a corresponding interim in 1954 of only 3½ per cent, may not be indicative of a higher distribution for the current year, such a possibility would not appear to be too unlikely when considered against the substantially increased output achieved so far. Indeed, during the first quarter of the current financial year output reached 62½ tons as against 21½ tons in the previous corresponding period. But in this respect it would be wise to bear in mind the warning of Mr. Donald W. Thomas, the chairman, in his statement to shareholders that the current year may well see some restriction in the output of Malayan tin mines. This, he said, was bound to have some effect on costs in relation to production. Rambutan £1 shares now stand at about 16s. to yield over 13 per cent.

Meeting, Redruth, Cornwall, January 26.

## Mining Men

Mr. C. B. Anderson has been appointed chairman, and Mr. E. M. T. Matthews a director of Marievale Consolidated Mines.

Mr. Arthur Ellinger has joined the board of the South West Africa Company.

Mr. K. S. Peacock, chairman and managing director of Guest, Keen and Nettlefolds Ltd., has been appointed a director of The United Steel Companies.

Mr. M. W. Richards has been appointed chairman and Mr. E. J. Read a director of Geduld Proprietary Mines.

Mr. J. B. Richardson has been selected as Visiting Lecturer in 1955 to the University of the Witwatersrand under the Visiting Lecturers' Trust Fund. Mr. Richardson will be in Johannesburg from the end of March until the middle of May.

Mr. T. P. Stratten has been appointed chairman, and Mr. E. J. Read a director of East Geduld Mines.

Sir Eric Young and Mr. Andrew Lyell have joined the board of the South West Africa Company and Mr. S. H. Boileau has resigned.

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## WEST AFRICAN GOLD

Company	November, 1954			Months since year end	Current Financial Year Total to date			Months since year end	Last Financial Year Total to date		
	Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)		Tons (000)	Yield (oz.)	Profit (£000)
Amal. Banket	86	13,526	28.9	2	167	26,639	64.4	134	21,406	34.7	
Ariston Gold	37	10,673	49.4	4	72	21,604	102.7	62	19,708	85.6	
Ashanti	27	16,420	69.4	4	53	32,759	139.4	48	30,484	129.1	
Bibiani (1927)	30	6,500	15.1	1	60	13,100	31.0	60	12,655	15.7	
Bremang*	670	3,148	11.0	11	5,713	26,417	34.7	6,047	28,402	119.6	
G.C.M. Reef	10	3,862	12.4	5	49	20,312	75.0	45	18,372	57.3	
Konongo	3	3,183	15.8	8	7	6,377	31.3	5	5,120	24.9	
Lyndhurst Deep	9	1,130	6.2	2	2	2,303	13.1	2	2,398	11.6	
Marlu Gold	35	2,932	8.3	2	73	6,204	18.6	82	8,445	35	
T. & Abosso	30	5,936	2.0	8	224	47,364	28.8	200	38,438	82.6	

\* Cu. yd. dredged

Profit figures include premium revenue

## COAL OUTPUT

Company	November (in tons)	Months Since Year End	Cumulative Totals (in tons)	
			This year to date	Last year to date
Amal. Coll. of S.A.	577,719	11	6,326,199	6,862,375
Apex	80,427	11	884,750	875,589
Blesbok	45,129	11	486,472	570,918
Coalbrook	23,530	11	100,328	977,280
Coronation	93,679	11	954,789	399,570
Dundee	28,878	11	147,707	586,551
Natal Navigation	98,644	5	510,582	518,005
New Largo	104,207	11	915,598	681,098
S.A. Coal Est.	141,610	5	677,233	787,855
Springbok	75,982	11	757,853	371,496
Transvaal & Delagoa	123,507	3	374,288	906,261
Van Dyks Drift	53,391	11	566,533	285,177
Vierfontein	96,523	11	888,029	468,864
Vryheid Cor.*	43,431	11	462,454	397,243
Wankie Coll.	36,028	11	388,917	626,339
Wankie Coll.*	302,601	3	818,792	37,648
Witbank	16,073	3	47,180	1,470,063
	145,682	11	1,465,733	

\* Coke

## TIN OUTPUT IN TONS OF TIN CONCENTRATES

Company	Nov.	Months since year end	Financial Year to Date		Company	Nov.	Months since year end	Financial Year to Date	
			This	Last				This	Last
EASTERN					NIGERIA				
Ampat	1204	11	1146	1154	Basich†	31	11	269	184
Anglo-Burma*	38	6	68	69	Ex-Lands	40	11	523	579
Berjantai	68	7	434	347	Gold & Base	39	11	448	496
Ipoh Tin	29	8	363	—	Gold & Base†	14	11	1364	94
Kamunting	90	8	736	898	Jantar	18	2	36	32
Kinta K. (a)	1	8	171	207	Jantar†	16	2	34	36
Kinta T.	39	11	317	318	Kaduna P.	4	11	64	107
Klang River	11	8	211	333	Kaduna S.	18	11	308	327
Kramat	50	8	228	—	Kell†	8	8	72	34
Kuala K.	224	8	1746	1256	Kell†	33	8	288	102
Kuchai	39	2	80	61	Lond. Nig.	14	8	184	187
Larut	119	11	1114	610	Naraguta Ex.	7	11	712	732
Lower Perak	148	7	1118	645	Naraguta K.	12	11	162	149
Malaysia	11	8	84	76	Naraguta T.	11	11	179	214
Pahang	220	4	880	880	Naraguta T.†	8	11	27	57
Rahman H.	38	6	179	196	Ribon	7	8	74	87
Rantau	66	5	308	289	Ribon†	12	8	8	—
Rawang Conc.	30	8	342	498	S. Bukeru	3	11	64	73
Rawang Tin	166	8	483	241	Tin & Ass. Min.	23	8	197	—
Renong	97	5	502	334	Tin & Ass. Min.†	28	8	268	—
S. Kinta(b)	388	8	3150	3001	Tinfields of Nig.	5	8	23	19
Siamese Tin	169	11	1751	1704	Tinfields of Nig.†	12	5	68	40
Sungei Kinta	10	11	142	204	U. Tin	3	5	18	1
Taipung	42	11	591	—	U. Tin†	—	—	—	—
Tambah	20	11	216	109					
Tanjong	70	11	686	717					
Tongkah	41	5	218	192					
NIGERIA					MISC				
Amal. Tin	304	8	2670	2669	Beralit Tin	6	8	37	64
Amal. Tin†	45	8	408	453	Beralit Tin†	172	8	1361	1528
Basichi	66	11	596	472	Creevor	54	8	412	450
					Sth. Crofty Tin	46	11	532	503
					Sth. Crofty Tin†	—	11	8	2

\* Quarterly

† Columbite

‡ Wolfram

§ 58 tons also recovered from Amang on old Pangnga Areas—year to date

a Dredge closed on November 8, 1954, for a period of approx. 2 months for conversion to electricity and a partial conversion to jigs

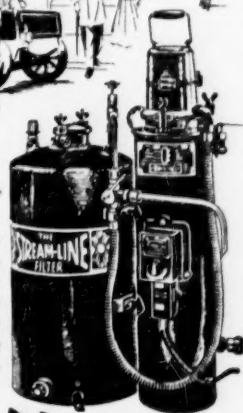
b Kinta No. 2 dredge closed down November 4-25, 1954, prior to entering the Kinta River



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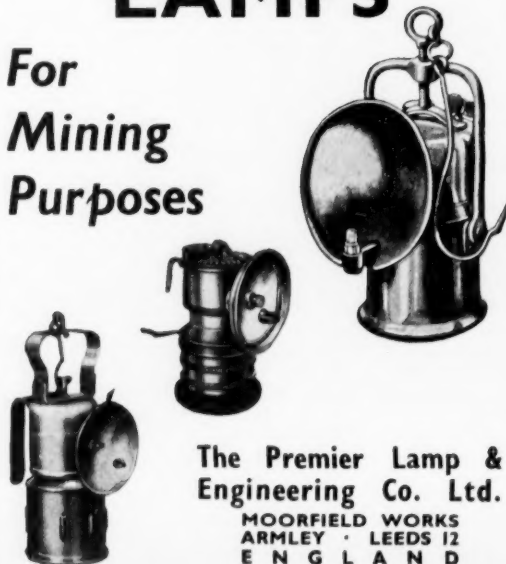
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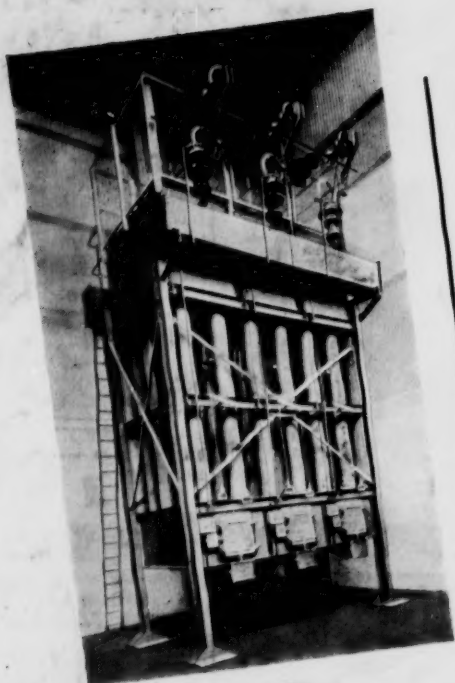
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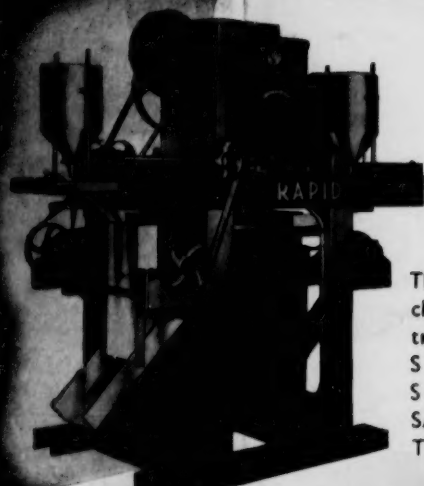
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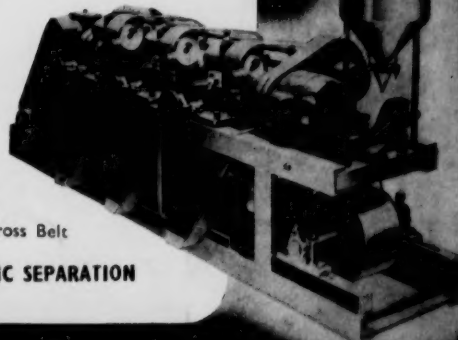
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